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R. U. DARBY

2,616,190

WALKING ANGLE CORRECTIVE FOOTWEAR

Filed June 14, 1946

2 SHEETS—SHEET 1

Fig. 1.

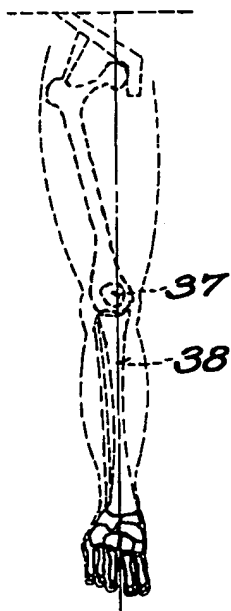
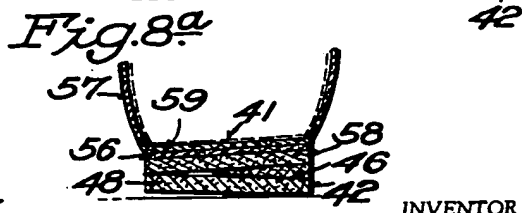
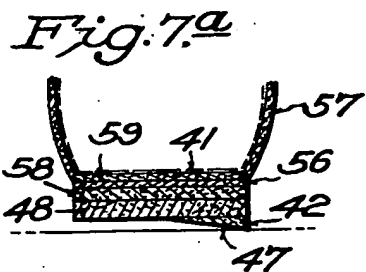
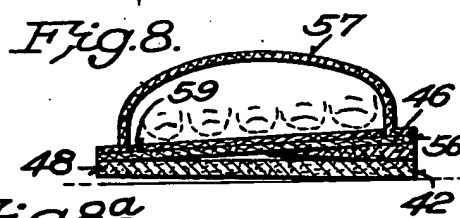
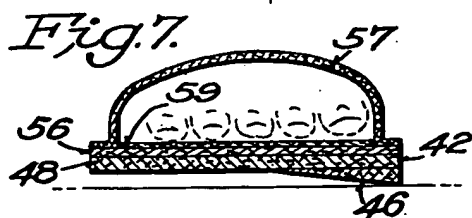
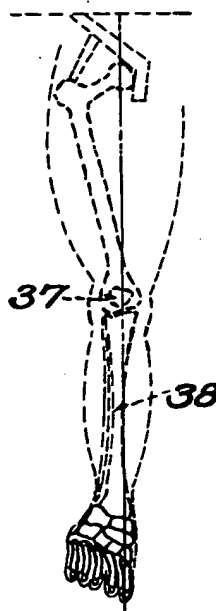


Fig. 2.



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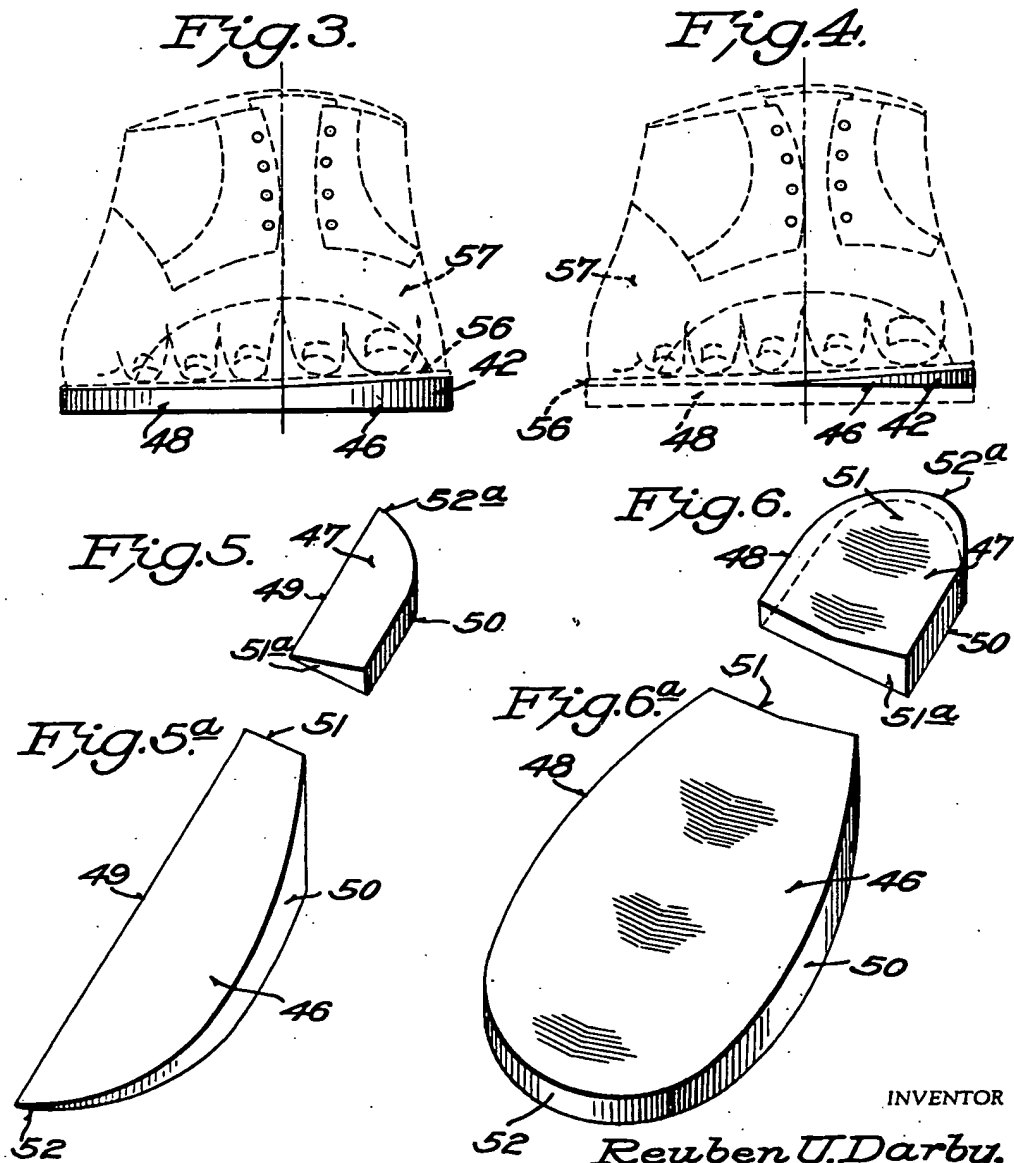
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WALKING ANGLE CORRECTIVE FOOTWEAR

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2 SHEETS—SHEET 2



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WALKING ANGLE CORRECTIVE FOOTWEAR

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3 Claims. (Cl. 36-71)

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This invention relates to the correction of human foot and leg disorders arising from incorrect weight bearing on the feet.

The lower extremity has a combination of small bones in the foot which are connected together by ligaments and muscles. The stronger muscles separating and controlling the movements of the foot are attached to the two bones above the ankle. These bones are known as the tibia and the fibula. The larger and medial bone, the tibia, has two functions, weight bearing and attachment for muscles supporting and controlling the feet. The lateral and smaller bone, the fibula, serves principally for muscle attachment. The tibia, or larger and two-function bone, is flat in front and has two margins, a medial and lateral one. The lateral margin if extended downward passes through the center of the talus, the first supporting bone of the foot, and through the center of the foot or slightly lateral to center on the small toe side. This is a normal walking angle. If this line passes medial to center or to the big toe side, the person has an incorrect walking angle which causes extra strain on the muscles and ligaments of the entire lower extremity, eventually throwing the whole skeletal system out of balance.

The invention provides for correcting this walking angle in the course of walking by elevating the medial side of the shoe or other footwear with an elevated outer fore-sole and heel, by means of separate non-integrally or integrally formed partial outer lift portions, for the medial side of the footwear in or on the bottom of the outer fore-sole and heel of the footwear of the wearer, so as to effect an adjustment of the bones on the medial side of the foot by the single upward motion of the bones on the medial side of the foot, unaccompanied by attendant rocking motion of the upper leg members, or twisting of the foot or shoe, and before the weight of the wearer is transmitted to the foot by the weight bearing members of the leg above the foot in the process of ambulation, thus correcting the walking angle. The amount of elevation is corrected to each individual's need. When a person places his foot in walking, his walking angle is corrected in perfect alignment with the bones of the leg, by the single upward thrust-movement that takes place upon the initial implanting of the shoe before the weight of the body is shifted over onto the advancing foot of the wearer in walking.

Alteration of the correct walking anatomical angle may produce a whole chain of deformities and disabilities. For instance, the arches of the

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foot may be looked upon as arcs which are concave downwardly and convex upward. There are transverse and longitudinal arches. Normally, the outer portion of the longitudinal arch is very low and almost rests on the ground. The inner part is high and only touches the ground behind. Normally there is a series of transverse arches extending from the arch formed by the heads of the metatarsals back to the arch formed by the navicular and the cuboid. The inner border of the foot is naturally straight, or concave inwards when weight is being borne. A vertical line dropped from the head of the femur through the patella and along the crest of the tibia should pass normally through the second intermetatarsal space (between the second and third toes) counting from the right hand side, viewing Fig. 1. Alteration of the correct walking angle, such as occurs in the case of flat-foot, results in the fore-foot being deflected laterally, the arch drops and becomes flattened, and the inner border which should normally show a slight concavity is replaced by convexity and the vertical line dropped from the head of the femur through the patella along the crest of the tibia, instead of normally passing through the second intermetatarsal space (between the second and third toes), passes internal to this space, toward the big toe side.

In correction of this, it would appear that this could be simply provided for by slightly elevating the medial side of the footwear of an individual requiring walking angle correction. This seemingly is most readily and simply done by means of arch supports and/or removable inner-sole inserts providing elevation for the heel and fore-part of the foot, as required on the medial side of the footwear of the individual. However, it has been found in practice that while such fore-sole and heel inserts, and arch supports, elevate the medial side of the foot, their use in practice is accompanied by other movements which defeat the intended correction of the walking angle, and introduce new and different discomforts to the wearer. For example, arch supports, in use by the wearer, exert upward pressure on the keystone of the arch tending to loosen it in an upward direction so that the transverse and longitudinal arches tend to collapse, the extremities being drawn toward each other by the muscles of the sole of the foot and the plantar fascia. Moreover, the weight of the body is by such arches transmitted from the talus directly to the shank of the footwear rather than as normally through the heel and the heads of the first and fifth meta-

tarsal bones to the outersole of the footwear and thence to the ground.

When such elevation correction is attempted by means of inserts in the form of inner-soles, it will be found that while such inner-sole elevation on the median side of the foot for the heel and foresole will elevate the bones of the foot as contemplated, in practice it will be found, however, that the walking angle nevertheless is not corrected and, as in the case of arches, their use in practice is accompanied by other movements which introduce new and different discomforts to the wearer.

It has been found that due to the rise and fall of the sole of the foot relative to the sole of the footwear, in walking, the elevation of the median side of the foot by means such as inner-soles which are raised or elevated on one side at the heel and foresole, is accompanied by a rocking motion. A dual movement takes place in which, for instance, the tibia and fibula rock laterally relative to the talus, thus introducing new discomfort, and resulting in a new and different in correction of the normal anatomical walking angle.

Where attempt to correct the walking angle, by use of such partial lifts for the median side of the foresole and heel, is made by attachment of such partial lifts to the outer bottom surface of the foresole and heel of footwear, a like dual motion is found to take place, and thus correction of the walking angle by such means seemingly is defeated by other accompanying movements of the foot and footwear relative to each other that take place in the normal course of ambulation.

In development of the present invention it has been discovered that while the employment of such partial lifts on the exterior bottom surface of the median side of the foresole and heel of the footwear is accompanied, as in the case of innersoles, by a dual movement, the additional movement which occurs is not equivalent but is instead a twisting movement of the shoe or footwear rather than a rocking movement of the upper limb members. It has further been found that the twisting movement is not a definitely discomforting movement, but merely aesthetically annoying, and moreover, it has been found that such employment of partial lifts for the purpose on the bottom of the sole and heel does not defeat the end of correcting the walking angle of the wearer in the course of ambulation.

It has still further been found in the development of the instant improvement in aid of simply and economically correcting the walking angle of persons requiring such aid, that when the partial lifts are employed as partial inter-lifts which are intermediate the upper surface of the bottom lifts of the fore out-sole and heel, and the bottom surface of the insole of the outer sole structure of footwear, that the aforesaid disadvantages are avoided and the action of correcting the walking angle takes place with a single movement rather than a dual movement. Superficially there would seem to be no fundamental difference in structure or function. However, with many patients who have been fitted with the three types for the purpose, in use it has been found to be a material and substantial difference in result insofar as correction of the walking angle and attendant comfort to the wearer is concerned.

In accordance with the present invention there

is provided for the footwear of individuals requiring correction of their walking angle, a partial outer-sole lift comprising separate outer fore-sole and heel lift portions for the medial (inner) side of the footwear. Each partial lift portion extends from the median line, or longitudinal central plane, of the shoe or footwear to the inner (medial) side margin of the same, and each is inclined to increase in depth from the inner median line to the inner margin of the footwear, where it is shaped to conform with the outline of the footwear. The foresole lift portion extends from the tip of the cap of the forepart of the footwear back to the front line of the shank, and the heel portion extends from the rear line of the shank to the back counter extremity of the heel of the footwear. The amount of elevation at the inner margin relative to the extremity at the central line of the footwear will vary according to the needs of the individual to whom the corrective is to be fitted, and of course each foretip and rear heel-portion is tapered in conformity with conventional shaping of the sole of the footwear. The amount of elevation chosen is selected so that, when fitted to a person whose foot is so shaped that a line dropped vertically from the patella along the crest of the tibia passes medial to center or to the big toe side, the elevation is sufficient to elevate the medial side of the forefoot and heel so that the vertical line then will pass through the center of the foot (between the second and third toes) or slightly lateral to center on the small toe side.

The partial outer-lift portions are, in accordance with the objects of invention, applicable in several ways to the footwear. For new shoes or other new footwear, the partial lifts are, or may be, incorporated in the original manufacture of the shoes or other footwear by assembling the separate but non-integral inserts or slips between the lower surface of the insole, or equivalent, to which the upper is attached, and the upper surface of the bottom-lift of the out sole or tread portion of the outer-sole structure of the footwear. Alternatively, the separate partial outer lift portions may be formed as an integral part of either the lower surface of the insole (or equivalent) or the upper surface of the bottom outsole lift or tread portion of the footwear, or, when the twisting action of the footwear is not objectionable the partial lift portions may then, within the contemplation of the invention be disposed on the bottom surface of the tread portion of the outer sole of the footwear, as by attachment as separate non-integral lift portions, or else formed as a separate but integral part, as by molding of composition outer lifts.

However, the invention contemplates the incorporation of the novel partial outer-sole lift portions, to both new and old shoes or footwear of conventional or standard commercial types by manufacturing the lift portions in different sizes and thicknesses, as non-integral separate articles of manufacture for application to old or new footwear by fitting and incorporation of them as inserts between in and out sole lifts, or as added sub-lifts for the bottom surfaces of the out soles of footwear, by ordinary skilled shoe or footwear repairers, as well as orthopedists.

An advantage of the novel outer sole partial lifts for footwear, and method, of the present invention is that of its simplicity and economy, as

well as full effectiveness for its intended anatomical correcting purpose.

The features of invention may readily and easily be incorporated in the original manufacture of the shoe or footwear from the same materials contemplated for the manufacture of the rest of the sole structure of the footwear, without modification of the process of manufacture of the rest of the footwear, and moreover the feature of invention after being applied to the article for wear is in a permanent and fixed relation relative to the rest of the footwear and foot of the wearer, and involves no looseness, or slipping or chafing. The features of invention are of particular merit and advantage for application to fabricated new and old footwear, in full accordance with the needs of individual wearers, by ordinary skilled footwear repairers, as well as orthopedists, since the novelty of the invention is so simple that its technique can be explained in ordinary lay language, and the average shoe repairer taught in a few minutes the correct manner of fitting, and the partial lifts can be prepared and incorporated in the footwear of the average person in as little as fifteen minutes to a half hour.

The invention has for further objects such other improvements and such other operative advantages or results as may be found to obtain in the structure and method hereinafter described and claimed.

In the accompanying drawing forming a part of this specification, and showing for purposes of exemplification, the preferred form and manner of embodying and practicing the invention:

Figure 1 is a diagrammatic view illustrating the correct relationship of the bone structure of the human leg relative to the center of the foot, that is, the second intermetatarsal space, to wit, between the second and third toes, counting from the big toe side.

Figure 2 is a like view but illustrating the alteration in correct anatomical walking angle, which occurs as in the instance of so-called flat-foot, in which case a vertical line dropped from the head of the femur through the patella along the crest of the tibia passes medial to center, to the big toe side, resulting in an incorrect walking angle which causes extra strain on the muscles and ligaments, and eventually throws the whole skeletal system out of balance through the gluteus medius.

Figure 3 is a front elevational view of a shoe embodying one form of the present invention, in which the novel element, is integral with the sole.

Figure 4 is a like front elevational view of a shoe embodying another form of the present invention in which the separate novel element is formed as a unit non-integral with other parts of the whole outsole.

Figure 5 is a perspective view of the heel portion and Fig. 5a is a perspective view of the fore-sole portion of the outer-sole partial-lift, as used in the construction illustrated in Fig. 4.

Figure 6 and Fig. 6A are views similar to Figs. 5 and 5A, but illustrating the partial lift portions, as used in the construction illustrated in Fig. 3, wherein they are embodied as integral parts of the half sole and heel of the shoe of Fig. 3.

Figures 7 and 7a are cross-sectional views through the foresole and heel portions respectively of a shoe as in Fig. 3, but with the partial lifts of the invention attached to the exterior,

on the bottom surface of the lowermost tread lift of the foresole and heel.

Figures 8 and 8a are like cross-sectional views through Fig. 4, further illustrating the preferred embodiment of this invention.

In accordance with the present invention, for commercial application of the novel principles of the present improvement, there are provided two forms of construction, the form illustrated in Figs. 3, 6 and 6a being preferred, and the form illustrated in Figs. 4, 5 and 5a being next preferred.

In both forms, there is provided a partial outsole lift comprising a foresole portion 46 and a heel lift portion 47 for the medial side 42 of the whole outsole structure 48 of footwear.

The foresole lift portion comprises an outsole lift member having opposite extremities 49 and 50 coinciding with the median line and the medial marginal line respectively, of footwear, and a rear extremity 51 and forward extremity 52 coinciding with the front line of the shank and the tip of the cap forepart, respectively, of footwear, such as shoes, sandals, slippers, boots and the like.

The heel-lift portion 47 comprises a lift member for the outsole structure 48 having like opposite side extremities 49 and 50 coinciding with the median line and medial marginal line of the heel of footwear. The heel-lift portion also has forward and rear extremities 51a and 52a coinciding with the rear line of the shank and back edge of the heel portion of footwear respectively. Each portion is tapered toward the medial and marginal side extremity, to provide the progressive elevation, in the direction of the medial marginal side extremity, required to suit the needs of the individual in elevating the side of the foot on the inner side to shift the line of projection of a vertical line dropped from the patella 37 along the crest of the tibia 38 laterally toward the little toe side, so as to pass through the center of the foot or slightly lateral to center on the small toe side and thus correct the walking angle.

In the preferred embodiment of the invention the portions 46 and 47 are constructed to constitute intersole-lift portions as in Figs. 3, 4, 8, and 8a, 9a. Alternatively they are also constructed to constitute added sub-lifts as shown in Figs. 7, 7a, where the twisting action is not objectionable.

Advantageously the partial lifts 46 and 47 of invention are formed as pre-formed elements as illustrated in Figs. 5 and 5a, for application as units to separate and independent full half-sole lifts and full heel lifts customarily used in commerce, as illustrated in Figs. 8 and 8a.

Preferably, however, they are formed as integral parts of the full halfsole section and of the full heel section of the whole outsole structure for footwear, for instance, as shown they are formed as an integral part of a halfsole and a heel, by casting as a single unitary whole in a mold as from mastic or plastic composition material. It is considered better to have them formed with a horizontal bottom surface and their upper surface inclined as shown in Figs. 3 and 6 and 6a to constitute the upper surface of the slips or intersoles, or added sub-lift. The invention in its broader aspects also contemplates casting them as a unitary whole with the bottom surface of the insole, or equivalent, to which the upper of footwear is conventionally attached, and also to the bottom surface of the lowermost tread or lift in the relationship exemplified in

Figs. 7 and 7a, which may be done by turning the elements of Figs. 6, 6a, upside down, and using them so that the members 46 and 47 are still on the medial sides of the shoes, but for the other foot from which they normally are used, when the elements are employed as in Fig. 3.

In the embodiment of the invention shown in Figs. 3, 6, 6a, the novel partial lifts of invention are shown as formed, by casting in a mold, as a single unit with a full half sole and full heel lifts. The full half sole section and full heel section, with the integral lifts, are assembled with the insole 56, to which the upper 57 is attached, so as to have the partial lifts equivalent to inter-soles or slips in the whole out-sole structure, in which case they have the same orientation as that shown in Figs. 8 and 8a.

In the embodiment shown in Figs. 4, 5, 5a, 8 and 8a, the elements shown in Figs. 5 and 5a are fitted to the whole out-sole structure as previously non-integrally formed separate inter-sole lifts between the upper surface of the wear members and the bottom surface of the insole 56 to which the upper 57 is attached as conventionally. 58 indicates a conventional heel base and 59 a removable innersole inserted within the upper 57.

It has been found that for proper correction, conjoint elevation of the heel as well as the fore-sole is essential. However, the preformed fore-sole partial lifts may, in instances, be used without use of preformed partial heel-lifts, where the heel elevation is a minor one and may be built up by use of small pieces of scrap. Likewise, in instances, the preformed heel partial-lifts may be used without use of preformed foresole partial-lifts, where the foresole elevation is a minor one and may be obtained by use of scrap.

However, to attain the full advantage of the invention, in the conjoint use of the partial lifts for the foresole and the heel, the forward terminal extremity of the partial heel lift and the rear terminal extremity of the foresole partial-lift portions should coincide with the lines of the rear and forward extremities of the shank of the footwear, since the full advantage of restoring the normal orientation and structure of the arch of the foot becomes offset if the shank of the footwear is provided with artificial arch elevations, since they tend to unlock or loosen the arch by raising the talus, which acts as the interlocking keystone of the arch, and is defeated in so doing when elevated by supports at the shank region.

The invention as hereinabove set forth is embodied in a particular form and manner but may be variously embodied within the scope of the following claims.

I claim:

1. A walking angle corrective element for footwear comprising, a shoe halfsole comprising a generally flat body including a flat normally outer face and an inner face having a generally flat area along one longitudinal side of the body co-

inciding with the outer lateral side of a shoe for which the halfsole is designed to be applied from its median line to its outer lateral marginal edge, the remaining portion of the inner face along the opposite longitudinal side of the body having a raised portion coinciding with the medial side of said shoe and having opposite side terminal extremities coinciding with the median line and the medial side marginal line, and forward and rear terminal extremities coinciding with the line of the tip and the forward line of the shank, respectively, of the outsole structure of said shoe, said raised remaining portion of the inner face being inclined upwardly and outwardly from the said area to the opposite medial longitudinal edge of the body from the tip line to the forward shank line extremities.

2. A walking angle corrective element for footwear comprising, an outsole full foresole lift portion having a flat face on one side thereof and having formed on its opposite face a tapered partial foresole lift portion, said partial lift portion having opposite side terminal extremities respectively coinciding with the median line and the medial side marginal line, and having forward and rear terminal extremities coinciding with the line of the tip and the forward line of the shank respectively, of the outsole structure of footwear to which the element is designed to be applied, said partial lift portion being of greater height at the region of its medial marginal portion than at the region of its median line portion, to raise the inner side of the forepart of the human foot the required distance for correcting the walking angle.

3. A structure as defined in claim 1 wherein said walking angle corrective element is integrally formed with a half sole of the footwear.

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